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ABSTRACT

This paper describes the research and development of a fully World Wide Web-based credit course in the English Department at the University of Waterloo (Ontario). One hundred students from across Canada complete four exercises in technical writing over a four-month term. In the process, they learn to understand and apply the principles of SGML (Standard Generalized Markup Language) design in their assignments and in the profession generally. Their assignments are converted and displayed on the course Web site for markers' assessments and for their shared use. Students employ the same tools, software and designs that the instructors use to create all aspects of the course materials. Through this exposure, they are able to evaluate instructional methods by practicing them in their own work. Half the course grade is derived from students working entirely online in groups of three. All aspects of instruction are supervised and integrated by instructors using newsgroups, chat, online tutorials and instructor comments. A commercial version of the course is available to organizations for their training needs. (Author/AEF)

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Authoring and Development in an Online Environment: Web-based Instruction Using SGML

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

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ED 429 530

Abstract: This paper describes the research and development over two years of a fully Web-based credit course at the University of Waterloo. 100 students from across Canada complete four exercises in technical writing over a four month term. In the process they come to understand and apply the principles of SGML design in their assignments and in the profession generally. Their assignments are converted and displayed on the course web site, (at url: http://itrc.uwaterloo.ca/~engl210e/) for markers' assessments and for their shared use. Students employ the same tools, software and designs we use to create all aspects of the course materials. Through this exposure they come to evaluate our instructional methods by practicing them in their own work. Half the course grade is derived from students working entirely online in groups of three. All aspects of instruction are supervised and integrated by instructors using newsgroups, chat, online tutorials and instructor comments. We are now making a commercial version of the course available to organizations for their training needs.

Introduction: the Overview

Because this course is extensive in its content, learning options and scope of application, I wish to examine it under these categories. An overview of its **technical structure** permits the reader a view of both our **conceptual notions** of its use and the **administrative controls** necessary to operate it. We can provide something of the course from a **student perspective**. Our **research** from the outset, in the choice of an SGML learning model, has influenced how we make the course available and how we encourage participants to further develop their skills and knowledge. We are now investigating subject-specific materials for uses in other academic and business applications. We have expanded our research to include how individuals learn, how groups who meet only via the Web work together and how companies can begin to use their employees as collective resources to begin complex training within their own organizations in an entirely online environment. Finally, we have begun to **commercialize** our tools and software to make packages available to partners and clients in business for them to author and offer full-scale, interactive, web-based learning in any subjects of their choice.

Technical Structure

This course, English 210G in its credit mode in the English Department at the University of Waterloo, consists of some 5, 200 files in primarily HTML format on a fileserver running Linux and Apache. It also runs on Sun UNIX machines. The course is extensive in its contents of some thirteen 'modules' of various technical writing topics in interactive formats, an SGML editor, Document Type Definitions for some six technical writing documents, SGML converters to render the SGML data into HTML and RTF formats, software to enable multiple chat sessions and links to language tools, dictionaries and remote sites for information on technical documentation. The online assignments can contain full multimedia options, executable programs and CGI scripts and forms, though some of these latter require special arrangements for conversion. Students are encouraged to learn about and attempt sophisticated expressions but the grading centre of the course remains English standards of expression of text.

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The course is supervised by an instructors group consisting of the professor, the course contact personnel, technical support, markers and writing experts whom the students may consult via email from various locations within the course. A complete version of the course exists as a .tar file at our FTP site for distribution to partners in other research locations. All course materials are created and maintained as SGML master files which are converted and placed in directories from which users access them as HTML files from the course web site at the url listed above. Students create and convert their assignments by the same authoring processes we employ and this is one of the major instructional features of our pedagogy. Students submit all assignments to the course server as SGML files and they must convert completely there to HTML displays within the "View Student Assignment #" on the course Bulletin Board, at url http://itrc.uwaterloo.ca/~engl210e/BulletinBoard/ . We provide local conversion software so students can edit and test their documents prior to submission and we give what technical help we can in tutorials, FAQs and by responses to email to support a complex and often confusing process for remote users.

These student materials can be easily linked or incorporated directly into modules as illustrations and examples and advanced student projects can join the course as learning materials in their own right. We use SGML because our converters automatically update the resulting HTML files and their links and reduce web site maintenance while they guarantee complete accuracy of all links within our structure. The Course Administration Tool has been brought on line this fall to assist the instruction team in the maintenance of course accounts and the collection, conversion, distribution and return of student assignments which are administered and marked entirely in an SGML format. The instructor provides comments to the entire group, sets up and chairs chat sessions, edits newsgroups for content of general interest, maintains the Frequently Asked Questions lists and keeps specific course information current from an administrator's 'flight deck'. Inquiries on more technical issues are welcomed by Mr. Brian Cameron of the University's IST Group at email hesse@cuckoo.uwaterloo.ca.

An Instructor' View

English Technical Writing 210G is a comprehensive learning package which includes:

information about academic requirements
an introductory package at http://itrc.uwaterloo.ca/~engl210e/InformationDesk/IntroPackage/intro.htm
scheduling, and assignment submission requirements
the course administrative structures and personnel and complete class lists of names and email addresses
ftp and print options (at http://itrc.uwaterloo.ca/~engl210e/BookShelf/Introduction/CourseSoftware/)
information on technical writing standards, authorities and professional organizations
models and procedures for editing and assimilating online documents
tools and information sources for specific technical documentation.

It includes as software an SGML editor, InContext2, proprietary converters for HTML and RTF display from the SGML source documents and a series of Document Type Definitions specific to technical formal documents – the manual, report, letter and resume.

The course in its large-class expression accommodates over 100 students across Canada. Participants must have basic hardware requirements for Web access, email and a University account, rendered at time of registration. The SGML editor is available in a PC format only but we permit MacIntosh or UNIX users if they can provide their own editors. Weekly WebChats are optional but the sessions are posted on the Bulletin Board (url http://itrc.uwaterloo.ca/~engl210e/BulletinBoard/). Class members must participate in groups of three in the second and third assignments and their group mark applies to all members.

The large sections are composed roughly of 20% users from all faculties, using the campus watstar networks, 40% computer science and engineering students, many participating remotely from co-op work term placements and 40% as Distance Education students from work and home units at points across the country. Many senior students take the course as a way of becoming current with real business applications and practical sources for the reports and manuals for which they will be responsible in their career placements. Members of this latter group provide a great deal of the advanced technical knowledge manifest in some of the later assignment submissions, many of which are highly interactive and broad-ranging in their subject matter and illustrations.

Conceptualizing Online Learning

Perhaps the hardest thing for us to understand across the development of this project has been the levels of difficulty in reducing instructor involvement among the many, linked processes available to students. Common wisdom would urge that sophisticated data, complete and reliably developed, would provide a base for the confident execution of assignments clearly linked to it We have found that the course is elaborate in its design, with much more material, research capacity and personal communications features than are minimally necessary. It does, however, employ tools and processes in common use in business, so we believe our students will be expected to be familiar with these in work situations.

To account for the high degree of student and instructor involvement, we have coined the term 'richness' to describe the wide range of options for acquiring knowledge and exchanging opinions and information. In this sense, English 210G has proven to be quite untypical of both conventional classroom exchanges and of most other online learning expressions as well. Students concur that the experience is unique.

We conceptualize the model as a triad of data-communications-human interface and we have developed techniques to enhance individual learning in each sector. As well, we have integrated the sectors so parts of each link users at appropriate times to the other options. All our research effort now is directed to the transfer of human-controlled activities, with their high demands on personnel, into machine-assisted ways of providing answers to users. As example, we attempt to respond to course email as quickly as possible but we lack the resources for a full support service spread across a seven day week and five time zones. Our answer is to respond as best we can to each inquiry, but to capture the answer in a large, integrated FAQ database so subsequent questions can be directed as automatically as possible to it. The information in the base has to be linked in turn to the course data itself so users are prompted to it before they encounter the problem in communications or assignment areas. Solving these issues with enhancements to our software and modules is our most immediate task.

Student Perspectives

From the student's perspective, the course is, at first experience, a complex collection of online texts, communications devices, lists and tools for constructing and submitting SGML files to complete four course requirements in a series of progressively sophisticated technical documents. We have established the learning experience on two, linked metaphors. (Students, and my readers, can begin the demystification process with a Guided Tour at url: http://itrc.uwaterloo.ca/~engl210e/InformationDesk/engltour/tour.htm). The course Introductory Package is made available by FTP from the Home Page and is sent as floppy disks to all off-campus class members. Formal registration results in a course account for the duration of term.

The first is the course home page and depicts the floor plan of a small company specializing in technical documentation (url: http://itrc.uwaterloo.ca/~engl210e/) to which each student must apply for

employment by submitting a resume and letter of proposal to join a group. This is the first of four assignments and it initiates all members to the SGML editing and conversion processes and to each other and the course instructors by reading each others' proposals in the selection of partners to commence subsequent work.

The second metaphor is a simple bookshelf from which all aspects of the course can be selected as volumes (url: http://itrc.uwaterloo.ca/~engl210e/BookShelf/). These have links among themselves to provide learning connections among assignments, instructions, tips and supporting information, as well as contacts to subject -area experts and sources of additional specialized information.

The entire process is a loosely structured narrative in which the students, as employees, work within and for the company management, the instructors, to complete a series of real technical documents, under real time constraints, within the specifications, standards and models of a real contract. The 'tale' is set in a series of rooms within an organization where members can conduct research, create and modify interactive 'documents' for submission and online display, communicate with each other, individually or in groups and use the metaphors as settings to view in-course materials, external information sources, each others' work, course tutorials and instructors' comments on group activities and their personal progress. Members must interact with the instructors and each other in professional ways, communicate and conduct business formally and produce materials to a known and objective standard. They can view the assignments of all other members (as can any visitors to the web site at url: http://itrc.uwaterloo.ca/~engl210e/BulletinBoard/). While their electronically marked assignments are password-protected, they can request clarification on grades from the markers, refer to the assignment tutorial for further comaprisons and exchange any grade information and comments with classmates. Instructors arrange special chat sessions on a range of topics, on suggestion and by request, and collect information for all course members from email, newsgroups, chats and tutorials, to present it in the daily Instructors' Comments files. Students can consult all other course members from a course list of names, email addresses and, optionally, phone numbers.

Across the four months of the course students become familiar with SGML technologies at a clerical level. Only the most advanced can actually work with SGML design and structure issues at completion. Most become comfortable with an SGML editor, come to see its advantages in permanence and document design and understand basic conversion concepts. The course provides much additional information and help beyond their assignment needs and points to areas of learning they can pursue in employment later.

We presume an involvement rate of 8 hours per week for a conscientious student seeking to participate and to complete the assignments in good order – at about a "B" level. Depending on the individual's levels of technical experience – and the course **is** called '**technical writing**' -- , more time may be required at the outset. A point to note is that a new participant has a huge 'concept ball' to incorporate. We use email, an SGML editor, chat groups, newsgroups, interactive HTML displays and a large, image-mapped database of material, parts of which have to be explored merely to get assurance that you are observing the components of the schedule to not fall behind in unknown areas. We have had to make extensive additions to our design to assure readers that they have completed sufficient exploration to commence assignment preparation. Nervous members have to be assured that this is one course of five in a term and that they can complete it successfully in the allotted time.

Typically a student might spend six hours becoming familiar with an assignment within the course site, another six reading and incorporating materials to apply to a submission, six more over several days communicating with group members and friends on organizing the structure and detail of the joint response and an indeterminate number in learning 'technical' issues. Because these vary so much across the uninitiated, the very experienced, the highly motivated and the technically well-placed (like those working in good technical writing departments, with lots of collegial advice), it is hard to generalize about 'class experiences'. During this time a good deal of linked learning is going on. Because the course is so technical and innovative, many students provide guided tours for their buddies in computer science and

engineering – and we get good ideas from strange sources. Others become involved in ancillary databases like the Society for Technical Communications' web site. Some make contacts with our 'business support team' – technical writers who work with us from business situations and who advise students for volunteer service, but also to keep an eye on good recruits for their departments. These contacts have assured that we have had more available jobs than students in some six offerings of the course.

Students, across five thousand miles, form a working, academic unit in new ways. Not all participate actively in all parts of the course. Some use "chat" extensively and develop social contacts thereby. Others add to and use newsgroups, providing very specific information for particular systems issues. Some use them to develop social-pedagogic positions which they then incorporate in final reports and test in subsequent terms. We do not monitor email among individuals but we are aware of the amount of 'talking' that goes on throughout – and after – the term. Some of this percolates up to instructors as questions, ideas, suggestions, requests, at a very high level of intellectual involvement. And we try to capture this in feedback to the class via the instructors' comments, in aspects of 'Frequently Asked Questions' and in projects directed to new development and the revision of existing modules.

What the course is to students is hard to summarize. We have a majority of enthusiastic graduates, many of whom request additional learning in this mode. Drop-out rates are remarkable low, at about 5% where 25% in a course this size is common, but this may reflect the motivation and experience of members, many of whom are adults, often working from inside companies which then utilize their experiences and skills directly into online training projects using similar methods and technology. All off-campus participants must have Web access to join and the course applies a great deal of Web technology directly to learning and creation methods, so users experience a high degree of gratification. The course is immediately applicable in many of their other activities and it shows them powerful new tools, both within its own structure and at other locations. We encourage motivation in projects like comparing this course to other online learning models for credit and we often permit students to bring their own interests to assignments.

Those experiencing greatest difficulty, more as attitude than as situation, are on-campus members, some of whom never make the transition to a 'class that does not meet in a room'. Some pass the term seeking direct personal contacts for their instruction and support, unaware and uncaring that some 80% of their fellows live up to three thousand miles away from the fileserver on which materials are distributed. Some never self-motivate and for them the experience remains incomplete. Others understand and elaborate the concept of 'richness'. For these members, the added dimensions of enhanced communications, comprehensive records and the easy, efficient transfer of data make all aspects of the course desirable. They take the option of the subsequent specialized course, produce materials we then incorporate into the main course materials and often apply their new skills directly in business and government documentation departments.

Research

Our initial research lay in the development of the course itself. This consisted of determining the structures to permit a significant learning experience for a large, widely distributed group, in an entirely online format. This in turn required us to make decisions in late 1994 about the standardization and distribution of tools and hardware from our servers across the newly forming World Wide Web. A stint as Director of the Procedures and Documentation Department of a large Canadian Bank convinced me of the value of SGML as a concept and a technology by which I could provide a legacy to course members. Whatever new technologies emerge, the underlying virtues of SGML's structural requirements and its universality of expression across platforms convinced me that a) students wishing to become technical writers should understand the concepts and practices of 'mark-up' and that they should know the virtues of consistent structure within the idea of a 'document'. I also saw that these principles would continue to influence Web development, because HTML is a limited subset of SGML – the result of a more

comprehensively structured document design. If we could create even rudimentary converters to render accurate, complete SGML into HTML, and also into RTF for the full range of print options, we had a very useful set of tools for students – and a very powerful set of large-document development and maintenance software for commercial use. On these research premises we built the course, primarily with student labour. We have retained those development principles and, without exception, all members of watAGE have come to the company via the course, and all remained involved in the development of aspects of its design and operation.

We now conduct formal studies into how class members learn. We commence with analyses of four, optional, anonymous online evaluations across the term, between the submission and the return of marked assignments. We also have extensive profiles of individuals because they complete quite sophisticated resumes early in the course. We work directly with them in the development of their assignments, in groups and with individuals, and many complete their final work as an evaluation of their experience in the context of their field and subject of study. We know the locations and operating systems of all members as well. As a result, we can analyze individuals' background preparation, levels of participation, sources of support, among course materials, instructors, other students and off-site resources. This work is helping us very much in the design of new course tools and has led us to the major decision to split the learning process into an initial HTML-only course, with the same designs and materials and a subsequent experience, (still using our company-bookshelf metaphors, but with participants now as managers!) of SGML to an advanced stage of document design and DTD enhancement.

We have begun to understand that a major advantage of online learning is the individual's ability to study at one's own pace and depth of insight, at the times and for the duration one requires. This process more closely resembles 'private learning, reading, the study of texts, than it does conventional classroom activities. This pattern of searching, reflection, self-testing, is set in the context of expansive communications by the individual's ability to place ideas and questions to both instructors and one's peers, in various combinations of urgency. It allows for reflective responses and the careful addressing of specific aspects of a question to trusted sources – a friend, a knowing marker, a specialist. The major benefit of the technology is the controlled lapse between question and response – the student's highly valued ability to think before having to 'speak', or to even remain silent and observe, or ask some other member of the audience for an opinion. This heightened, broadened involvement makes a wonderful atmosphere for degrees of participation and student evaluations identify and praise it.

To build on our awareness, we want now to begin a major development of both course materials, but also of the 'learning environment' for ESL members, both within Canada and abroad. We want to enhance our already extensive writing tips – the many modules on the bookshelf – with guides, diagnostic and advice tools and templated modules through which students from language backgrounds other than English can develop technical writing expressions with confidence. We perceive this to be a real need ideally responsive to the online features which provide time to reflect, to retry solutions, to seek help privately. The world needs technical writing instruction and a majority of that world needs support and assistance in English expression as well.

Commercialization and Partnerships

The course is available presently as a credit offering and as a 'continuing education' (non-credit) as 'distributed education' within the University of Waterloo. We offer versions of the course to commercial organizations and government agencies for training in specific topics and company needs. We are in the process of forming the course as two units, the one instructing in HTML-based technical writing, the other providing SGML design and operation, and we have begun development of a package of our tools and data for license by companies to produce their own SGML-based online training and large-document management facilities. These products will be available in four months, with some good planning and good luck and can be examined and applied for at url: http://watage.com . We have seen the need for

English language training and support and are beginning to work with partners in the Czech Republic and Indonesia. We regard the need for administration tools to be as critical as any authoring/creation issues, though most software developers emphasize the latter and most novice instructors see their greatest need as the ability to create data in interesting, effective ways. Our 'online instruction product' will reflect the model we have come to respect from our experiences in developing the technical writing course. It will resolve instructor difficulties as an **authoring device** by using SGML technologies to create and support linked, sophisticated, interactive modules which we convert and maintain as HTML expressions. The **communications package** will contain an easily supervised set of email, newsgroup, tutorial, chat and instructor facilities to assure simple, reliable and extended information exchange among all members. Finally, the **Course Administration Tool** permits an instructor to build and modify course content in any subject area, including the installation of executable programs in the SGML structure. The instructor will be able to incorporate members of an entire class (possibly numbering in the hundreds) into the course account structure, by individual and group entries and build directories for the reception, marking and return of assignments and projects. In effect, the triad of 'data-communications-human interface' is addressed in a comprehensive, integrated set of tools and the resulting activity is maintained and distributed across the Web for application in any academic or corporate environment.

All of our experience, in the technology, but more importantly, among its users, is that this pedagogy will develop rapidly as a favoured choice in business, in education and among motivated learners around the world. We invite you to test the model with us and to participate at your level of need.